

REMARKS

The applicant respectfully request reconsideration in view of the amendment and the following remarks. Support for amended claim 1 can be found in the original claim 1, page 8, lines 15 to 17 and page 30, lines 28 to 30 of the specification. Support for newly added claims 24 and 25 can be found in the specification at page 30, lines 28-30. Support for newly added claims 26 and 27 can be found in the specification at page 8, lines 15-17. Support for newly added claims 28 and 29 can be found in the specification at page 17, lines 11-14. Support for newly added claim 30 can be found in the specification at page 8, lines 15 to 17, page 17, lines 11-14 and page 30, lines 28 to 30. No new matter has been added.

The applicant has cancelled three withdrawn claims. The applicant has added seven claims. The applicant respectfully requests that the remaining withdrawn claims be rejoined once it is determined that the pending claims are allowable. The applicant authorizes the USPTO to charge the undersigns AMEXP for the extra dependent claims added.

Claim 1 is rejected under 35 U.S.C. 112 as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. The applicant has amended claim 1 and change "obtainable" to "obtained" as suggested by the Examiner. For the above reasons, this rejection should be withdrawn.

Claims 1-16 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 6,607,856 (Suzuki et al.) in view of US 6,264,857 (Kreuer et al.) and US 7,288,603 (Sakaguchi et al.).¹ The applicant respectfully traverses this rejection.

The instant invention is directed to a new class of proton conductive polymer membranes which are based on polyazole polymers and polyvinylphosphonic acid (reactor blend).

¹ The Examiner has applied the wrong Sakaguchi reference. The U.S. patent has a 35 U.S.C. 102 (e) date of October 28, 2003 and is not prior art (the applicant's filing date is July 31, 2003). However, the PCT counterpart of Sakaguchi published May 16, 2002 (prior to the applicant's German priority date).

In order to practice the invention, the respective monomers, to form the polyazole polymer, are mixed in step A).

The mixture in step A) further contains vinyl-phosphonic acid (as monomer for the later polyvinylphosphonic acid).

In step B) the polyazole polymer is formed by polycondensation.

Thereafter, in step C) a film can be casted which still contains the vinyl-phosphonic acid (as monomer for the polyvinylphosphonic acid) which is polymerized in step D). Since the two polymers are formed by different polymerization methods, they can be formed independently. Since the film still contains the vinyl-phosphonic acid (as monomer) being uniformly distributed, an Inter Penetrating Network (IPN) is formed.

The instant invention provides a proton conductive polymer membrane which shows proton conductivity of at least 0.001 S/cm @ 120°C (see page 30, lines 28 to 30) (see claim 1). In order to achieve the aforementioned proton conductivity, the amount of vinyl-containing phosphonic acid is at least 20% (See page 8, lines 15-17 of the specification and claim 1) (after polymerization these vinyl-containing phosphonic acid monomers form the polyvinylphosphonic acid).

Suzuki discloses solid polymer electrolyte IPN membranes. It is true that Suzuki disclose that, e.g. polybenzimidazole, can be used as hydrocarbon part-containing polymer compounds (see Suzuki, col. 5, lines 10 to 45). However, Suzuki focuses on sulfonic acid type graft membranes (see Suzuki, example 1 and the formula, top of col. 10).

Suzuki does not disclose a polymer membrane that uses at least 20% of the vinyl-containing phosphonic acid. Suzuki discloses the addition of polyvinylphosphonic acid or the addition of vinyl-phosphonic acid monomer (the applicant believes that the highest amount disclosed is about 7%; see example 18).

The proton conductivity of the membranes taught by Suzuki solely relies on the grafted sulfonic acid groups. In other words, there is no proton conductivity of at least 0.001 S/cm @ 120°C. The amount polyvinylphosphonic acid is too small to show any proton conductivity. Example 18 of Suzuki was investigated in a Declaration of Dr. Thomas Schmitt (see copy attached) from other BASF Fuel Cell GmbH case (US 2005-0147859 A1). It is noted that the applicant already filed an IDS citing US 2005-0147859. As can be seen, the amount of 7% polyvinylphosphonic acid (mixing the monomer) shows a conductivity of less than 10^{-5} S/cm at 160°C. It is noted that the temperature is higher in the declaration (160°C then in the claims (120°C), however, the applicant believes that the result still would be much lower at 120°C than the applicant's claimed minimum. The problem to be solved by Suzuki is to trap metal ions by the chelate groups (Polyvinylphosphonic acid) and not to obtain proton conductivity at 120°C (see Suzuki, col. 4, lines 43 to 51).

Suzuki teaches away from the applicant's minimum conductivity and minimum amount of vinyl-containing phosphonic acid is present in step A) as required in claim 1. Furthermore, Suzuki teaches away from dependent claims 24-27 and 30.

Kreuer discloses solid polymer electrolyte membranes. It is true that Kreuer discloses that, e.g. polyphosphonic acid, can be used as high molecular weight acid (see Kreuer, claim 1).

However, Kreuer discloses the presence of an amphoteric material having a low molecular weight (not more than 1000g/mol). Furthermore, Kreuer teaches away from claims 28-30.

Sakaguchi disclose solid polymer electrolyte membranes based on polyazoles having sulfonic acid groups or phosphonic acid groups at the polyazole backbone. The applicant believes that the closest disclosure in Sakaguchi can be seen in Example 9, which adds a small amount of polyvinylphosphonic acid to a polymer solution of a sulfonated polyazole. It may be possible that they can form an IPN because both are in solution. However, even in solution an entangling of the polymer backbones (already being formed, it must be kept in mind they add/mix the polyvinyl-phosphonic acid and the sulfonated polyazole; not the monomers as the applicant does).

However, the amounts of Polyvinylphosphonic acid in the final membrane seems to be very low, because they measure the proton conductivity in said example at 80°C and 95% RH (relative humidity).

A statement that modifications of the prior art to meet the claimed invention would have been “obvious to one of ordinary skill in the art at the time the invention was made” because the references relied upon teach that all aspects of the claimed invention were individually known in the art is not sufficient to establish a *prima facie* case of obviousness without some objective reason to combine the teachings of the references. *Ex parte Levengood*, 28 USPQ2d 1300 (Bd. Pat. App. & Inter. 1993). See MPEP § 2143.01 IV. “[R]ejections on obviousness cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *KSR International Co. v. Teleflex Inc.*, 82 USPQ2d 1385, 1396 (2007) quoting *In re Kahn*, 441 F.3d 977, 988 (Fed.

Cir. 2006). Furthermore, the Examiner cannot selectively pick and choose from the disclosed parameters without proper motivation as to a particular selection. The mere fact that a reference may be modified to reflect features of the claimed invention does not make the modification, and hence the claimed invention, obvious unless the prior art suggested the desirability of such modification. *In re Mills*, 916 F.2d 680, 682, 16 USPQ2d 1430 (Fed. Cir. 1990); *In re Fritch*, 23 USPQ2d 1780 (Fed. Cir. 1992). Thus, it is impermissible to simply engage in a hindsight reconstruction of the claimed invention where the reference itself provides no teaching as to why the applicant's combination would have been obvious. *In re Gorman*, 933 F.2d 982, 987, 18 USPQ2d 1885, 1888 (Fed. Cir. 1991). For the above reasons, this rejection should be withdrawn.

In view of the above amendment, applicant believes the pending application is in condition for allowance.

A fee for the 4 extra claims over twenty is included. Applicant believes no additional fee is due with this response. However, if a fee is due, please charge our Deposit Account No. 03-2775, under Order No. 15588-00007-US from which the undersigned is authorized to draw.

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Respectfully submitted,

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